LIST OF VOCABULARY ABOUT TOPIC “OSCILLATION AND WAVE”

Topic 1: OSCILLATION

1. *Vocabulary*

Number	Word	Phrase	Phonetic transcription	Meaning in Vietnamese
1	Oscillation	Noun	/ˌɑːsɪˈleɪʃn/	Dao động
2	Harmonic	Adjective	/hɑːrˈmɒn.ɪk/	Điều hòa
3	Equilibrium	Noun	/ˌiː.kwɪˈlɪb.ri.əm/	Cân bằng
4	Displacement	Noun	/dɪˈspleɪs.mənt/	Li độ
5	Amplitude	Noun	/ˈæm.plɪ.tʃuːd/	Biên độ
6	Period	Noun	/ˈpɪə.ri.əd/	Chu kì
7	Frequency	Noun	/ˈfriː.kwən.si/	Tần số
8	Phase	Noun	/feɪz/	Pha
9	Pendulum	Noun	/ˈpen.dʒə.ləm/	Con lắc
10	Spring	Noun	/sprɪŋ/	Lò xo
11	Damp	Verb	/dæmp/	Làm giảm
12	Resonance	Noun	/ˈrez.ə.nəns/	Cộng hưởng

2. *Physics concept*

Number	Concept	Definition	Reference source

1	Oscillation	An ***oscillation*** is defined as a disturbance in a physical system that is repetitive in time. Oscillation is when something is swinging back and forth.	(Fitzpatrick, 2018)
2	Vibration	***Vibration*** is a mechanical phenomenon whereby oscillations occur about an equilibrium point. ***The difference between "oscillation" and "vibration":*** while "oscillation" refers to a repetitive movement around an equilibrium position, "vibration" has a broader meaning, encompassing oscillation but also referring to shaking or irregular movements.	Oxford Dictionary
3	Simple Harmonic Motion	Periodic motion or harmonic motion is a motion that repeats at regular intervals. ***Simple harmonic motion*** is particular type of periodic motion. It is such a motion which can be written as a cosine or a sine of time. Examples of situations include: a mass on spring, a pendulum,…	(Halliday, Resnick, & Walker, 2014)
4	Equilibrium	According to a mass on spring situation, the ***equilibrium*** state of the system refers to the situation in which the mass is at rest.	(Fitzpatrick, 2018)
5	Displacement	The ***displacement x(t)*** of a particle from its equilibrium position.	(Halliday, Resnick, & Walker, 2014)

6	Amplitude	The ***amplitude A*** of the oscillation is the largest value that *x(t)* achieves, *x(t)* bounces back and forth between *A* and -*A*.	(Morin, 2014)
7	Period	The ***period T*** of the oscillation is the time for one full oscillation. $$T = \frac{1}{f}$$ *"Capital T equals one over f."*	(Halliday, Resnick, & Walker, 2014)
8	Frequency	The ***frequency f*** of the oscillation is the number of times per second that it completes a full oscillation (a cycle) and has the unit of hertz (abbreviated Hz). $$f = \frac{1}{T}$$ *"f equals one over capital T."*	
9	Phase	The ***phase*** of motion $\boldsymbol{\varphi}$ dictates where in the cycle of motion the mass is at any time, which express the position and direction of motion of an oscillating particle. After one period $\boldsymbol{T}$, one complete oscillation is executed, corresponding to a phase change of $\boldsymbol{2\pi}$. At any arbitrary time $\boldsymbol{t}$, the phase change is given by: $$\varphi = \frac{2\pi}{T}t$$ *"Phi equals two pi over T (capital T) multiplied by t."*	(Fitzpatrick, 2018)

10	Damped Simple Harmonic Motion	The mechanical energy E in a real oscillating system decreases during the oscillations because external forces, such as a ***drag force***, inhibit the oscillations and transfer mechanical energy to thermal energy. The real oscillator and its motion are then said to be ***damped***.	(Halliday, Resnick, & Walker, 2014)
11	Drag force	Like friction, the drag force always opposes the motion of an object.	
12	Resonance	***Resonance*** is a condition where an external driving force's angular frequency ω_d matches the natural angular frequency ω of a system. When $\omega_d = \omega$, the system's velocity amplitude v_{max} and oscillation amplitude A reach their maximum values, leading to amplified oscillations.	(Fitzpatrick, 2018)
13	Driving force	The ***driving force*** is an external influence that causes a system to change its state of motion, particularly in the context of oscillations.	Oxford Dictionary
14	Potential energy	The ***potential energy*** $\boldsymbol{U(t)}$ of the system, which is the same as the potential energy of the spring. It can be determine through the magnitude of the restoring force. $$\boldsymbol{U(t) = -\int F(x)\,dx = \frac{1}{2}k\big(x(t)\big)^2}$$ *"U of t equals negative integral of F of x dx, equals one-half k times x of t squared."*	(Halliday, Resnick, & Walker, 2014)

		At the points of maximal stretch or compression, where the mass is instantaneously at rest, the potential energy reaches a maximum value: $$U(t)_{max} = \frac{1}{2} m\omega^2 A^2$$ *"Maximum U of t equals one-half m omega squared A squared."*	
15	Kinetic energy	The kinetic energy of the system, which is the same as the kinetic energy of the mass. Its value depends on how fast the block is moving, that is velocity *v(t)* of motion. $$K(t) = \frac{1}{2} m\left(v(t)\right)^2$$ "K of t equals one-half m times v of t squared." When the mass passes through the equilibrium point, where the spring is neither stretched nor compressed, the kinetic energy reaches a maximum value: $$K(t)_{max} = \frac{1}{2} m\omega^2 A^2$$ *"Maximum K of t equals one-half m omega squared A squared."*	

3. Physics law and formula

Number	**Name of physics law**	**Content**	**Formula**	**How to read the formula**

1		***The displayment of SHM***: Simple harmonic motion is a sinusoidal function of time *t*. This equation is called the ***simple harmonic oscillator equation***.	$$\boldsymbol{x(t) = A\cdot\cos\varphi = A\cdot\cos(\omega t + \varphi_0)}$$	x of t equals capital A times cosine phi, which is capital A times cosine of omega t plus phi zero.
2		***The velocity of SHM:*** To find the ***velocity v(t)*** as a function of time, let's take a time derivative of the position function *x(t)*. ***At the central point***, the ***velocity amplitude*** $\boldsymbol{v_{max} = \omega A}$ is the maximum speed.	$$\boldsymbol{v(t) = \frac{dx(t)}{dt} = -\omega A\cdot\sin(\omega t + \varphi_0)}$$	v of t is the time derivative of x of t, which equals negative omega times capital A times sine of omega t plus phi zero.
3		***The acceleration of SHM:*** By differentiating the velocity function $\boldsymbol{v(t)}$ with respect to time to get the acceleration function of the particle in simple harmonic motion. ***At the maximum displacement***, the ***acceleration amplitude*** $\boldsymbol{a_{max}} =$	$$\boldsymbol{a(t) = \frac{dv(t)}{dt} = -\omega^2 A\cdot\cos(\omega t + \varphi_0)}$$	a of t is the time derivative of v of t, which equals negative omega squared times capital A times cosine of omega t plus phi zero.

		$\boldsymbol{\omega^2 A}$ is the maximum magnitude of the acceleration.		
4	Mechanical energy conservation	When simple harmonic motion have an ideal system with no damping forces, energy should be conserved.	The total energy of the mass is written: $$\boldsymbol{E = K + U = \frac{1}{2} m\omega^2 A^2}$$	E equals K plus U, which is one-half m omega squared times capital A squared.

4. ***Physics exercise***

Number	Problem	Solving
1	A mass-spring system consists of a block of mass $m = 0.5\ kg$ attached to a massless spring with spring constant $k = 50\ N/m$. On a frictionless surface, the spring is stretched by $0.1\ m$ from its equilibrium position and released from rest. 1. Calculate the total mechanical energy of the system.	**Total Mechanical Energy:** The total mechanical energy E of a mass-spring system is the sum of its kinetic energy K and potential energy U. At the maximum displacement (amplitude), the kinetic energy is zero, and ***the total energy is equal to the potential energy*** stored in the spring. Using the formula: $$\boldsymbol{E = U_{max} = \frac{1}{2} kA^2}$$ Replacing the given values: $$\boldsymbol{E = \frac{1}{2} \times\ 50 \times (0.1)^2 = 0.25\ J}$$ So, the total mechanical energy of the system is 1 J.

	2. Determine the maximum speed of the block during its oscillation.	**Maximum Speed of the Block:** The maximum speed v_{max} occurs when the block passes through the equilibrium position, where ***all the energy is kinetic***. Using the formula: $$\boldsymbol{E = K_{max} = \frac{1}{2}mv_{max}^2}$$ Solving for v_{max}: $$\boldsymbol{v_{max} = \sqrt{\frac{2E}{m}} = \sqrt{\frac{2 \times 0.25}{0.5}} = 1\ m/s}$$ Thus, the maximum speed of the block is 1 m/s.

Topic 2: WAVE

1. *Vocabulary*

Number	Word	Phrase	Phonetic transcription	Meaning in Vietnamese
1	Wave	Noun	/weɪv/	Sóng
2	Disturbance	Noun	/dɪˈstɜːbəns/	Nhiễu loạn
3	Propagate	Verb	/ˈprɒpəgeɪt/	Lan truyền
4	Medium	Noun	/ˈmiːdiəm/	Môi trường
5	Transverse	Adjective	/trænsˈvɜːs/	Ngang
6	Longitudinal	Adjective	/ˌlɒndʒɪˈtjuːdɪnəl/	Dọc
7	Reflection	Noun	/rɪˈflɛkʃən/	Sự phản xạ
8	Refraction	Noun	/rɪˈfrækʃən/	Sự khúc xạ
9	Diffraction	Noun	/dɪˈfrækʃən/	Sự nhiễu xạ
10	Interference	Noun	/ˌɪntəˈfɪərəns/	Sự giao thoa

2. *Physics concept*

Number	Concept	Definition	Reference source
1	Disturbance	In the definition of wave, a ***disturbance*** is a change from the current state of a measurable quantity at some location. The word ***disturbance*** originates from the 14th century. It comes from the Latin word "disturbare" which means "to shake" or "to	(Elert, 1998)

		disturb”. This Latin term is a combination of “dis-” (meaning “apart”) and “turba” (meaning confusion or trouble).	
2	Propagate	To propagate is to spread or disperse something to increase its presence or impact. In the definition of wave, to ***propagate*** is to transmit the influence of something in a particular direction. The word disturbance is a combination of “pro-” (meaning “forward”) and “agare” (meaning to drive or lead).	(Elert, 1998)
3	Medium	A medium is the substance through which a wave can propagate. For example, water is the medium of ocean waves. Air is the medium through which we hear sound waves. The electric and magnetic fields are the medium of light.	(Elert, 1998)
4	Wave	A ***wave*** is a ***disturbance*** that ***propagates*** through a ***medium***. All ***waves*** can transfere energy from one place to another without transferring any matter. This is done by a series of disturbances or vibrations that carry the energy.	(Halliday, Resnick, & Walker, 2014)
5	Mechanical waves	***Mechanical waves*** common examples include water waves, sound waves, and *seismic* waves. All these waves have two central features: They are governed by Newton’s laws, and they	(Halliday, Resnick, & Walker, 2014)

		can exist only within a material medium, such as water, air, and rock.	
6	Electromagnetic waves	***Electromagnetic waves*** common examples include visible and ultraviolet light, radio and television waves, microwaves, x rays, and radar waves. These waves require no material medium to exist.	
7	Transverse waves	A ***transverse wave*** is one in which the direction of the disturbance is *perpendicular to* the direction of propagation. Example: Light waves and electromagnetic waves ****Perpendicular to:*** at an angle of 90° to another line or surface	(Elert, 1998)
8	Longitudinal waves	A ***longitudinal wave*** is one in which the direction of the disturbance is *parallel to* the direction of propagation. Example: Sound waves ****Parallel to:*** a line that is always at the same distance from another line	
9	Reflection	If a surface reflects light, heat, sound, or an image, it sends the light, etc. back and does not absorb it.	(Halliday, Resnick, & Walker, 2014)
10	Refraction	When water or glass, etc. refracts light or sound, etc., it causes it to change direction or to separate when it travels through it.	

11	Diffraction	The *divergence* of wave from its initial line of travel is called diffraction. ****Divergence*** is a drawing apart (as of lines extending from a common center).	
12	Interference	***Interference between two waves*** happens when they have the same frequency and produce a force that is either stronger or weaker than one wave alone. In ***Young's interference experiment***, light passing through a single slit falls on two slits in a screen. The light leaving these slits flares out (by diffraction), and interference occurs in the region beyond the screen. A fringe pattern, due to the interference, forms on a viewing screen.	(Halliday, Resnick, & Walker, 2014)
13	Constructive interference	Interference that produces the greatest possible amplitude is called fully ***constructive interference.***	Oxford Dictionary
14	Destructive interference	Although we sent two waves along the string, we see no motion of the string. This type of interference is called fully ***destructive interference.***	Oxford Dictionary
15	Maxima	The points where two waves meet ***in phase*** (two crests or two troughs coincide), resulting in constructive interference and maximum amplitude.	(Halliday, Resnick, & Walker, 2014)

16	Minima	The points where two waves meet ***out of phase*** (a crest coincides with a trough), resulting in destructive interference and minimum amplitude.	
17	Interference fringe	The alternating light and dark band generated by interference.	
18	Sound waves	***Sound waves***, one type of mechanic waves, travel through air, elements of air are disturbed from their equilibrium positions. ***Sound waves*** are divided into three categories that cover different ***frequency (f)*** ranges. 1. ***Audible waves*** lie within the range of sensitivity of the human ear. $(16Hz \leq f \leq 20000Hz)$ 2. ***Infrasonic waves*** have frequencies below the audible range. $(f \leq 16Hz)$ 3. ***Ultrasonic waves*** have frequencies above the audible range. $(f \geq 20000Hz)$	
19	Electromagnetic wave	An ***electromagnetic wave*** consists of oscillating electric and magnetic fields. The various possible frequencies of electromagnetic waves form a spectrum, a small part of which is visible light.	(Halliday, Resnick, & Walker, 2014)

		All electromagnetic waves, no matter where they lie in the spectrum, travel through free space (vacuum) with the same *speed c*.	
20	Range of electromagnetic waves	Maxwell’s rainbow is a wide spectrum (or range) of electromagnetic waves, this scale is arranged based on wavelength, or the corresponding frequency. Maxwell’s rainbow includes: - Gamma rays - X rays - Ultraviolet (tia cực tím) - Visible spectrum (ánh sáng khả kiến) - Infrared (tia hồng ngoại) - Radio waves (sóng vô tuyến) - Long waves	(Halliday, Resnick, & Walker, 2014)
21	Standing waves	The interference of two identical sinusoidal waves moving in opposite directions produces ***standing waves***. ***Standing waves*** are characterized by fixed locations of zero displacement called ***nodes*** and fixed locations of maximum displacement called ***antinodes.***	(Halliday, Resnick, & Walker, 2014)

22	Node	A point along a standing wave where the wave has minimal amplitude. At these points, there is no motion because the two interfering waves cancel each other out. This occurs where the two waves are in exactly opposite phases.	Oxford Dictionary
23	Antinode	A point along a standing wave where the amplitude is at a maximum. These points occur where the two waves are in phase and constructively interfere, producing the maximum displacement in the medium.	Oxford Dictionary

3. *Physics law and formula*

Number	Name of physics law	Content	Formula	How to read the formula
1		***Sound level*** quantifies the intensity of sound that the human ear can detect. Because the range of detectable sound intensities is so wide, a logarithmic scale is used to measure sound level.	***Soud level*** is defined by the equation: $L = 10\log\left(\frac{I}{I_0}\right)$ This is measured in decibels (dB).	Capital L equals ten times the logarithm of the ratio of I to I zero.
2		The ***fringe width*** in young's double-slit experiment is	$\boldsymbol{i = \frac{\lambda D}{d}}$	i is equal to lambda times D divided by d.

		proportional to the distance of separation between the slit and the screen and inversely proportional to the separation of the slits.	i is the fringe width of the interference pattern λ is the wavelength of the light D is the distance between the slits and the screen d is the distance between the two coherent slits.	

4. ***Physics exercise***

Number	Problem	Solving
1	In a Young's double-slit experiment, the distance between the two slits is 0.5 mm, and the screen is placed 2 m away from the slits. The light source used has a wavelength of 600 nm. Calculate the fringe spacing (fringe width) on the screen.	The fringe width (or fringe spacing) in Young's double-slit experiment is given by the formula: $$\boldsymbol{i = \frac{\lambda D}{d}}$$ where: $\lambda = 6 \times 10^{-6} m$ (wavelength of light) $D = 2m$ (distance between slits and screen) $d = 5 \times 10^{-4} m$ (distance between slits) Substituting the values: $$i = \frac{\lambda D}{d} = \frac{6 \times 10^{-6} \times 2}{5 \times 10^{-4}} = 2.4 \times \ 10^{-3} m = 2.4mm$$

		So, the fringe width is **2.4 mm**.

TÀI LIỆU THAM KHẢO

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